

## **DETENT JOINT**

### **Cross Reference to Related Application**

**[0001]** This application claims priority from a German Application filed July 14, 2003 under Serial Number 10331868.2.

### **Background of the Invention**

**[0002]** The instant invention is directed to a detent joint, primarily for use with external mirrors of vehicles, but also with any external mirror which may require such a detent joint.

**[0003]** External mirrors of vehicles are generally fastened to the vehicle by means of one or several brackets.

**[0004]** Preferably swivel joints are employed to make it possible to pivot the mirror from the original position in which the mirror is set, essentially perpendicular to the side of the vehicle into a second position, in which the mirror stands essentially parallel to the side of the vehicle. This arrangement makes it a possibility to fold this mirror into the side of the vehicle during transport and parking decreasing its overall width or to fold the mirror back against the side in order to avoid, or at least diminish damage to the mirror upon collision with an obstacle as the case may be.

**[0005]** Advantageously, the swivel joints are designed in the nature of the detent joints, which engage the second position for at least the above-described reason – that means they oppose the clearly heightened resistance of the torque around the axis of rotation. Aside from that, still other detent positions can be made available which

enable different basic positions while keeping the possibility for adjustments of the mirror pane relative to the mirror. In order to adjust the mirror's surface relative to his sitting position, the driver can initially bring the entire mirror to a suitable basic position and then adjust the angle of the mirror pane exactly for his position.

**[0006]** A similar arrangement is taught by EP 1 092 589. In this arrangement a first hinge piece, on which the mirror can be secured, as well as a second hinge piece for the attachment to the vehicle are provided. Both hinge pieces are joined together in such a way as to be rotated about a rod. This motion is accomplished by two arms of the first hinge piece which cooperate with second two arms of the second hinge piece, and a cylindrical part set in between. The cylindrical part is fixed to the second hinge piece by means of two clamp blocks that partially encompass its circumference. The cylindrical part has several evenly-spaced external notches on its circumference on the side turned toward the first hinge piece. A complementarily formed detent element is pushed back and set in the first hinge piece in the radial direction and is spring-forced in this direction, so that in each case one of the notches of the cylindrical part is engaged allowing the hinge pieces relative movement in the radial direction.

**[0007]** If the first hinge piece is turned around the second, the detent element is moved out of a notch against the resistance of the spring and, by the strength of the spring, is pushed into the next notch as soon as it lies directly across from the detent element, thus resulting in different detent positions. Because the cylindrical part is pivoted to the second hinge piece in different positions, the detent positions can be secured arbitrarily as regards the second hinge piece.

**[0008]** The primary drawback to this arrangement is that the detent joint consists of many pieces which results in costly manufacturing and unwanted tolerance of the joint as a result of the tolerance chains. Also, the stroke direction of the detent element must always lead radially through the axis of rotation, so that no disequalibrated torque is induced. This line of engagement of rotation of the axis-detent engagement-stroke of the detent element requires a relatively large space in the direction of the stroke. The larger lever arm controls the hinged position of the external mirrors which results in destabilization of the detent joint.

**[0009]** It is an object of the instant invention to provide a detent joint which is tolerance-free as much as possible and by which the rotation axis may be arranged outside of the line of engagement. A further object of the instant invention is to make an external mirror with a tolerance-free detent joint and in which the axis of rotation may be placed outside the line of engagement.

### **Summary of the Invention**

**[0010]** The above objectives are accomplished according to the present invention by providing a detent joint which consists of first and second hinge pieces which are connected to each other by the detent joint and where an axis of rotation is firmly secured to one of the two hinge pieces and around which the other of the two hinge pieces is pivoted. A detent element is set in a plane perpendicular to the rotation axis and is pushed back in the direction of engagement by a spring element. The detent surface includes at least two teeth protruding out of the surface. The second

hinge piece has a counter surface formed with complementary notches which act to receive the at least two protruding teeth of the detent element engage in at least one detent position.

**[0011]** Because at least two teeth are always engaging with corresponding notches in the counter surface, these teeth are being pushed into the adjacent flanks by the opposing power component in the direction of the circumference, so that the detent joint is automatically centered in an essentially tolerance-free manner. To this, the teeth and the corresponding notches can be formed if desired to be essentially wedge-shaped.

**[0012]** Because the necessary torque required for positioning the mirror is distributed to several teeth, the impact on the single teeth is diminished which lessens wear and tear.

**[0013]** Automatic centering of the detent joint makes it also possible to arrange the rotation axis outside of the line of engagement.

**[0014]** In a preferred embodiment, the detent element is received in a slide bearing so that it can only be pushed back in the direction of engagement.

**[0015]** In one especially preferred embodiment, according to the invention, a forward and/or back stop is provided in the slide bearing in the direction of engagement. A forward stop prevents the detent element from being pushed out of its track by the spring element, while a back stop limits the maximal downward deflection of the spring.

**[0016]** The detent element always remains in the first piece under a spring pre-load due to forward and back stop limits in the slide bearing. The back stops may

include a pin tightly secured to or integrally formed with the first hinge piece and positioned to slide in a slot formed in the slide bearing. This arrangement enables assembly of the hinge piece to include a pre-stressed detent element as a semi-finished part or, as a spare piece.

**[0017]** The detent joint, according to the invention preferably does not allow the direction of engagement to intersect with the axis of rotation. This arrangement provides a very compact short model in the direction of engagement which is free of intersections and undercuts respectively. Alternatively, in certain instances it may be desirable that the arrangement be constructed with the direction of engagement aligned to intersect with the axis of rotation. Advantageously, the axis of rotation may be arranged in the second hinge piece which carries the detent element in such a position that the hinge piece can be twisted in such a way that the detent element can be installed or removed. This additionally simplifies the assembly.

**[0018]** The spring element may comprise a flat spring that supports itself in the detent element and a first hinge piece, in such a way that it pushes the detent element in the direction of engagement. The detent element is advantageously pushed sideways to the direction of engagement in its track, which increases stability.

**[0019]** Likewise, the spring element can also include a coil spring or can be implemented by use of the detent element collectively as one piece.

**[0020]** In one especially preferred embodiment, the detent element contains more than two teeth.

**[0021]** In an embodiment that is just as especially preferred, the counter surface contains more than two complementarily formed notches, so that the at least two teeth of the detent element can engage in more than one detent position in the complementarily formed notches and, so doing, are able to implement several detent positions.

### **Description of the Drawings**

**[0022]** The construction designed to carry out the invention will hereinafter be described, together with other features thereof.

**[0023]** The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings forming a part thereof, wherein an example of the invention is shown and wherein:

**[0024]** Fig 1 is a cutaway rear view of an external mirror and detent joint according to the invention.

**[0025]** Fig 2 is a cutaway top view of the external mirror and detent joint.

**[0026]** Fig 3 is an exploded rear perspective view.

**[0027]** Fig 4 is an exploded front perspective view.

### **Description of a Preferred Embodiment**

**[0028]** Fig 1 shows an external mirror which is adapted to be attached to a vehicle and includes a detent joint. The external mirror includes a first hinge piece 1

attached in suitable manner with a second hinged piece 2. First hinge piece 1 is connected with the second hinge piece 2 by way of rod 4 which is set in the axial direction in bores 12, 14 as an axis of rotation. Rod 4 contains an over-flange 41 and an under-flange 42 which secures it with hinge pieces 1, 2. Alternatively, rod 4 can be set in position with bolts, adhesives, or other such means. With respect to the axis of rotation A, an essentially cylindrical front face surface 11 is provided with the inner surfaces of the upper and lower arms of first hinge piece 1.

**[0029]** Rod 4 also passes through second hinge piece 2, joining the first and second hinge pieces in such a way that they can be pivoted about the rotation axis A. Thereby, the first hinge piece 1 is engaged with the second hinge piece 2 in the area of the axis of rotation by rod 4 which extends in the axial direction, so that both hinge pieces are axially joined with each other.

**[0030]** Rod 4 can also be integrally formed with the first or second hinge piece. In this case, the track of the other arm, carried by the rod, can be formed from several pieces and can be assembled around the axis of rotation. Likewise, rod 4 may be attached to one of the hinge pieces; not only in axial but also in rotational direction, which, reduces the tolerance of the joint. Upper and lower slide bearings 8 are formed in the arms of first hinge piece 1 which receive detent elements 5 in such a way that they can be pushed axially of the arms as seen in figure 2, but do not interfere with the axis of rotation.

**[0031]** The upper and lower arms of first hinge piece 1 form slide bearings 8 including a slot 9 of selected length on their top and undersides, respectively. Detent

elements 5 are positioned in bearings 8 under or over said slots 9 respectively. Bores 15 are formed in detent elements 5 in position to lie beneath or above slots 9. Pins 10 are provided to pass through slots 9 and engage in bores 15. Each pin 10 may be slightly tapered allowing the detent element to be more axially tolerance-free. Slots 9 along with pins 10 form a forward and back stop with a primary function of controlling the length of movement of the detent elements 5 back in the direction of engagement with counter surface 7. The detent element 5 is forced in the direction of engagement with counter surface 7 by a flat spring 6 arranged with a preloaded force. The flat springs 6 are supported in slits 16 formed in the sidewalls of the detent element 5. This structure beneficially reduces the tolerance necessary of the detent joint.

**[0032]** A nib 18 in the slide bearing 8 acts to deform the flat spring 6 providing the preloaded force which maintains force on pin 10 and detent 5 in the direction of the forward limit of the stop and second hinge piece 2 in each of the forward and back stop positions of slot 9.

**[0033]** Each detent element 5 includes three teeth 51 which, as seen in Fig 2, are essentially formed wedge-shaped. The second hinge piece 2 carries an essentially arcuate counter surface 7 contoured about the rotation axis A and including complementarily notches 51. This structure allows the second hinge piece to be advantageously formed of fewer assembly pieces than conventional hinge pieces.

**[0034]** Springs 6 urges the detent elements 5 forward in the direction of engagement with counter surface 7. The cuts or notches 17 of the counter surface 7 lie

directly across from the teeth 51 so that the teeth are pushed into the notches and held there. This way detent joint 5 is engaged in one detent position.

**[0035]** With the application of a torque around the axis of rotation, the teeth 51 are pushed out against the pressure of the flat spring 6 in the direction toward the back, out of the notches 9 allowing hinge pieces 1 and 2 to be moved relative to the axis of rotation. As soon as the teeth 51 move into position directly across from different notches in the counter surface 7, teeth 51 are urged into these notches by the force of springs 6 and held there. This way, detent joint 5 is engaged in another detent position and hinge pieces 1 and 2 are held in different relative positions.

**[0036]** Advantageously, the flanks of the teeth generate a torque as soon as they move into the corresponding notches of the counter surface until they are completely engaged in the notches. This allows the detent joint to centralize itself automatically, even when the line of engagement does not intersect the rotation axis.

**[0037]** In this way a tolerance-free detent joint is set according to regulations. As displayed in the example according to Figs 1-3, the detent joint moves along an axis perpendicular to and laterally spaced apart from the rotation axis so that the rotation axis A may advantageously be set outside the line of engagement resulting in a compact, short model in the direction of engagement.

**[0038]** To the assembly, either the detent elements 5 with the flat springs 6 can be inserted in the slide bearing and secured by means of pins 10. Then this semi-finished part can simply be axially fixed to the second hinge piece, by driving rod 4 through both hinge pieces 1 and 2.

**[0039]** Hinge pieces 1 and 2 could then be pivoted about the rod 4. Subsequently, because of the advantageous assembly of the rotation axis, both hinge pieces can be pivoted so far that the slide bearing 8 of the first hinge piece 1 is spaced from counter surface 7 and is exposed. In this position, the detent elements 5 along with flat springs 6 could be installed and then secured by the pins 10. The first hinge piece 1 is pushed back into an engaged position by which the front 11 of the first hinge piece 1 lies directly across from the counter surface 7 of the second hinge piece.

**[0040]** While a preferred embodiment of the invention has been described using specific terms, such description is for illustrative purposes only, and it is to be understood that changes and variations may be made without departing from the spirit or scope of the following claims.